殺虫剤に対する家蠅の忌避性 : 忌避剤・誘引剤について 第1報

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laboratory tests by the usual dipping method as shown in Table 5, was higher than the effect of the γ-BHC+camphor mixture and further, when half part of γ-BHC was substituted by α′-chlorocamphor, it showed better effect than γ-BHC alone on a certain dilution. According to this result, it is seemed that camphor derivative has a some joint action for γ-BHC.

On the insecticidal effect of the DDT+camphor derivatives mixture against the adults of the azuki-bean weevil as shown in Table 6, the DDT + α′-chlorocamphor mixture was higher than the effect of DDT alone or DDT+camphor mixture alike γ-BHC but the effect of the α-bromocamphor+DDT mixture was lower than the DDT+camphor mixture. So, it is seemed that α-bromocamphor has a antagonistic action for DDT.

A Laboratory Method for Test of Repellency against Adult Housefly. Insect Repellents and Attractants. Part I. Yasunosuke IKEDA (Takamine Laboratory, Sankyo Co., Ltd. Yasu-cho, Shiga Pref.), Received July 31, 1957. *Botyu-Kagaku* **22**, 323, 1957.

55. 殺虫剤に対する家蠅の忌避性* 忌避剤・誘引剤について 第1報

池田安之助（三共株式会社 高峰研究所） 32. 7. 31 受理

忌避効果の判定法として，lactose pellet を用い，その効力表示法について検討した．すなわち，供試薬液をしみこませた濾紙の中央に約 50mg の lactose pellet（薬剤を全く含まない）を置き，底面のみを金網とした硝子張り箱 24×24×15cm の中に設置し，約 120 匹のイエバエをこの中に放した．忌避効果の判定は，この試験器中に放飼したイエバエの 20 時間内に摂食する lactose の量を基礎とするもので，得られた値には次式を採用して効力の強弱を表示した．

$$摂食率=f_i=m_i/\sum m_i\times 100 \qquad 忌避率=r_i=(f_c-f_i)/f_c\times 100$$

m=lactose 摂食量 (mg)，i=試験に用いられた供試薬剤番号，c＝無処理区．

勿論，この方法から得られる値は比較的なものであつて，忌避的効力を定量的に表示するものではないが，その再現性は大きい．数種薬剤の効力比較の反復試験値にはほとんど同じような結果があらわれた．この比較試験の結果，ピレトリン，アレスリンがもつとも忌避作用強く，大部の有機塩素剤ではその作用は弱かつた．特にオルソ・ジクロルベンゼンでは忌避作用が急速に消失して無処理区と差がなかつた．

Introduction

It has been well known that repellent substances are used chiefly to protect man, livestock and plant from the attack of insects. Most of these substances do not kill the insects but protect the plants and animals by repelling them[5,12,14].

The search for chemicals possessing insect repellent properties started in the early of the twentieth century. Later, a large number of organic compounds were tested in addition to effectual compounds as repellents recommended by various investigators from time to time[3,5,7~10,13].

On the other hand, with the development of chemical repellents, various methods for the evaluating repellencies such as bait traps, feeding tests, or olfactometers have been designed by numerous workers[1,4,13,15].

The olfactometers are widely used for ascertainment of repellency in the laboratory tests. Bruce[2], in his study of the repellencies of chemicals to houseflies, reported on the use of lactose pellet for the determination of residual repellencies.

It is the purpose of this work to deal with a modified method[2] in testing and describing the method of evaluating results.

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Factory manager, and Mr. Y. Hamada, the Chief of chemical laboratory of this company for their helps and to Miss. M. Kondo for her assistance during the course of the work.

Methods and Materials

The insect used was the common housefly, *Musca domestica vicina* Macq., reared in this laboratory. Approximately 120 adult houseflies of 2-3 days old were used for each test.

The chemicals adopted for test were allethrin, pyrethrins, chlordane, dieldrin, DDT, lindane, *o*-dichlorobenzene, and sulfoxide. These materials were prepared either in kerosene or in xylene solutions.

The tests were conducted in the glass box of 24×24cm and 15cm high, with wire net in the bottom.

In the tests, xylene or kerosene solutions containing a given concentration of the materials were applied at a rate of 0.2cc per filter paper of 5cm in diameter.

The impregnated filter papers were kept at 28° for the different time. After a given time had elapsed, in the center of each of the treated paper was placed about 50mg lactose pellet. These were put into a glazed test box containing about 120 houseflies.

The evaluation of repellency was based on the amount of feeding on lactose pellet placed on each paper. After the exposure of 20 hours the lactose pellet were removed and weighed. The amount of lactose pellet (mg) fed by flies were calculated by the following formula :

$$\text{Percentage feeding} = 100 \times \frac{\text{The feeding amount (mg) in each material}}{\text{Total amount of the feeding (mg)}}$$

(Total of every individual during test period)

In the above equation that of the check was included.

Percentage of repellency was computed in this manner, applying a formula generally known as Abbott's formula[11] to the percentage feeding obtained.

$$\text{Percentage repellency} = 100 \times \frac{\text{Percent of feeding in check} - \text{Percent of feeding in treatment}}{\text{Percent of feeding in check}}$$

Results of Test I

Eight materials having the following percentages of toxicants were tested : pyrethrins 0.1%, allethrin 0.1%, lindane 0.5%, sulfoxide 1.0%, chlordane 2%, dieldrin 2%, DDT 5%, and *o*-dichlorobenzene 25%. Each of these materials was formulated in kerosene solution and the results are given in Table 1.

Table 1. Relative effectiveness and durability of test materials in kerosene solutions against the adult of the common housefly, *Musca domestica vicina* Macq. in laboratory tests.
Exposure for 20 hours at 28°~30°C. Average of three replicates.

Formula Toxicant gram in 100cc kerosene	Dosage in mg per 20 cm²	Repellency per cent Days after treatment						
		1	2	3	4	5	8	11
Pyrethrins 0.1	0.2	··	100.0	··	100.0	83.4	42.7	14.6
Allethrin 0.1	0.2	··	100.0	··	98.3	80.5	26.5	10.6
Lindane 0.5	1.0	··	100.0	··	98.3	43.5	14.5	0.0
Sulfoxide 1.0	2.0	··	100.0	··	95.4	43.5	0.0	··
Chlordane 2.0	4.0	··	100.0	··	100.0	58.3	25.5	0.0
Dieldrin 2.0	4.0	··	100.0	··	100.0	51.6	0.0	0.0
DDT 5.0	10.0	··	100.0	··	89.0	44.8	0.0	··
o-dichlorobenzene 25	50.0	··	100.0	··	47.2	3.9	0.0	0.0
Kerosene alone	0.2cc	33.3	27.2	13.5	0.0	0.0	··	··

As shown in Table 1, pyrethrins were markedly more effective than the other materials. It is interesting to note that the effect of allethrin had a resemblance to those of pyrethrins. The other materials, except *o*-dichlorobenzene, showed the moderate effectiveness, while *o*-dichlorobenzene tested in the present work, had almost no effect to the houseflies. It is probably due to the rapid evaporation of this material.

Results of Test II

In the second tests, all these materials were formulated in a 5% xylene solution. Solvent itself has some repellency to insects and the low volatility of solvent causes some disturbance to the result of evaluating repellency of chemicals. For these reasons, instead of kerosene, xylene was used as solvent in this test.

The results of three replicates are given in Table 2.

As shown in Table 2, pyrethrins and allethrin gave good effects. Residual effect of pyrethrins and allethrin up to 26 days was attained, but these dosages were about 50 times as much as common practical use.

Discussion

The writer intends to express the repellency of chemicals to houseflies simply and clearly. The method adopted in this paper, is not complete one but the orders of repelling effect of chemicals are clearly determined by these expression of this method, however, it is insufficient to express the true ratio fully. In the first test, kerosene with the lower volatility has repellent property slightly so that kerosene disturbed the results. However, when a higher volatile solvent such as xylene was used, instead of kerosene in the second test, there was no effect of solvent on the evaluating repellencies.

In the early stage of tests, till about 5 days afterwards, there was considerable evidence that flies were affected by residues. Obviously, it was due to direct contact with the treated paper, that is to say, the materials have less effects on repelling flies. If material has ample repellent action, it must be keeping the flies away from the treated paper. It is advantageous that chlorinated hydrocarbons which possessing the long lasting insecticidal efficiency have little or no repellent effect, after certain solvents are evaporating off : if these materials were repellents, they could not kill insects by the contact with residues.

While, in the tests, pyrethrins and allethrin, not with standing they are contact insecticides, gave high repellency and prevented flies from feeding on lactose pellets for 3 days.

Résumé

In the present paper, the writer dealt with the technique for evaluating the repellent efficiency to the adult of the common housefly and described the method of evaluating results. The method

Table 2. Relative effectiveness and durability of test materials in xylene solutions against the adult of the common housefly, *Musca domestica vicina* Macq. in laboratory tests.
Exposure for 20 hours at 28°~30°C. Average of three replicates.

Formula: Toxicant gram in 100cc xylene		Dosage in mg per 20 cm²	Repellency per cent: Days after treatment									
			1	3	5	9	13	22	26	35	45	50
Pyrethrins	5	10	··	100.0	··	98.2	97.0	··	79.0	10.0	3.9	0.0
Allethrin	5	10	··	100.0	··	88.3	86.9	··	79.0	10.2	0.0	0.0
Lindane	5	10	87.0	77.4	··	76.8	57.4	··	17.3	0.0	··	··
Dieldrin	5	10	95.6	74.1	··	60.7	53.6	··	0.0	··	··	··
Sulfoxide	5	10	72.4	70.5	··	66.8	38.3	0.0	··	··	··	··
DDT	5	10	87.0	82.8	··	41.1	30.7	0.0	··	··	··	··
o-Dichlorobenzene	5	10	50.0	31.4	6.5	0.0	0.0	0.0	··	··	··	··

employed, in this work, was a modification of that described by Bruce. The insect used was the adults of the common housefly which have been bred in the laboratory. The materials adopted were allethrin, pyrethrins, chlordane, dieldrin, DDT, lindane, *o*-dichlorobenzene, and, sulfoxide, and each of these was formulated in kerosene or xylene solutions. In the tests, kerosene or xylene solutions containing a given concentration of the materials were applied at a rate of 0.2cc per 20 square cm filter paper. The impregnated filter papers were kept at 28° for various time. After a given time had elapsed, about 50mg of lactose pellet was placed in the center of each paper, these papers with pellets were put into a glazed test box containing about 120 houseflies.

The criterion of repellency was based on the amount of feeding on lactose pellet put on each paper. After the exposure of 20 hours the lactose pellets were removed and weighed. The amount of feeding (mg) obtained were presented by formulae as mentiond above.

In laboratory tests it was noted that pyrethrins and allethrin were markedly more effective than the other materials. These materials prevented flies from feeding on lactose pellet for 3 days. Other chlorine compounds, except *o*-dichlorobenzene, gave moderate effectiveness in repelling houseflies. Although *o*-dichlorobenzene was tested in the work, it was less effective against houseflies.

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